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EDITORIAL.

Soil Erosion.

Soil erosion in Malaya has not been the serious problem that it has assumed in certain other countries; nevertheless, the damage from this cause has been considerable, and in many cases permanent, while the danger to health which so frequently accompanies erosion, by providing breeding places for malaria-carrying mosquitoes, has been ever present.

Mr. J. R. P. Soper, in an article entitled "Soil Erosion on Penang Hill" outlines the damage done to this beauty spot by soil erosion, and summarizes recent legislative action designed to prevent further erosion in this area.

The efforts being made at Penang are of more than local interest, for in the adoption of measures with a similar object in other parts of the country doubtless advantage will be taken of the experience gained by the Penang authorities.

Plant Hormones.

Research carried out over a number of years by the scientists of many countries established the fact that plant hormones are connected with the growth of roots. This basic fact led to the discovery of several synthetic hormones, some of which are now sold under proprietary names.

The investigations on plant hormones and their substitutes has attracted considerable attention, one might almost say that there has been a wave of optimism as to the virtues of these substances and of their value in agriculture. While we wish in no way to minimise the value of this advance in agricultural practice and are convinced that the application of synthetic hormones will become an established factor in plant propagation, we consider that caution is necessary before accepting the use of these substances in the economic production of plants. It is the considered opinion of many practical horticulturists and agriculturists in the United Kingdom that experiment is necessary on a small scale with any particular crop as a preliminary to their systematic employment.

At our request Dr. T. W. Brown contributes a concise statement of the present knowledge of plant hormones and their substitutes. His article should prove a valuable guide to those who wish to apply knowledge on this subject to Malayan agriculture.

Sugar and Alcohol from Nipah.

Mr. V. M. Hinchy, late Distillery Manager of the now defunct Nipah Distilleries of Malaya Ltd., favours us with an original article on the relation between frond transpiration and yield of sap in the nipah palm which we publish in this number.

The author shows that the daily variation in flow of sap when the flowering spathe of the palm is tapped is directly related to humidity, being greater when the weather is dull and the humidity high than during periods of bright sunshine, when the humidity is low.

He omits, however, to provide evidence that a greater total quantity of sugar is obtained with the increased quantity of sap on dull days. The investigations of Eaton and Dennett published in this Journal about fifteen years ago showed that the sugar content of the sap varies considerably, but they also omitted to correlate volume of daily sap with sugar content of sap.

Mr. Hinchy makes the interesting suggestion that the provisions of suitable shade trees on a nipah plantation would probably be effective in reducing transpiration and therefore in maintaining optimum sap flow.

The author has recently published in *The International Sugar Journal* an article on "The Commercial Production of Sugar from the Nipah Palm" which we reprint on another page. The present articles, with those which have appeared in *The Malayan Agricultural Journal* during the past years therefore give a complete account of the experimental work and commercial exploitation of the palm in Malaya.

The reader may well question our further publicity on this subject in view of the fact that the commercial venture has collapsed. We maintain, however, that the value of this palm as a potential source of sugar and especially power alcohol remains unimpared by the failure of the pioneer effort to commercialize the nipah products. Under estate conditions the palm is capable of producing over an unknown period of years an annual output of about 1,000 to 1,500 gallons of power alcohol per acre, and it requires but little imagination to visualize in time when this readily available source of fuel will once more claim public attention.

Mr. O. T. Faulkner, C.M.G., B.A.

It has been common knowledge locally for some weeks that Mr. O. T. Faulkner, C.M.G., Director of Agriculture, Straits Settlements and Adviser on Agriculture, Malay States, has been selected to fill the important post of Principal of the Imperial College of Tropical Agriculture, Trinidad, and by the time these lines appear in print the transfer will be a *fait accompli*, for Mr. Faulkner sailed from Malaya on 23rd. September to take up the duties of his new appointment.

Mr. Faulkner has filled the post of head of the Department of Agriculture, S.S. and F.M.S., for barely two years. He has guided the Department with wisdom and foresight and his influence on Malayan agriculture will long survive his departure from this country.

We wish Mr. and Mrs Faulkner farewell and will greatly miss them both, in Mr. Faulkner's official capacity and in the social atmosphere which they created.

Original Articles.

SOIL EROSION ON PENANG HILL

By
J. R. P. Soper,
Agricultural Officer, Province Wellesley and Penang.

Introduction.

The erosion of soil from the slopes of Penang Hill has for several years been a source of misgiving to many. In the first place streams have been silting up, thereby causing difficulties in irrigating and draining the padi land through which they flow on the final stretch of their journey to the sea. Secondly, the clearing of forest and scrub, besides leading to erosion, also increases the breeding places of anopheline mosquitoes. Thirdly, soil wealth in the form of the fertile top layers is being lavishly wasted by foolish methods of cultviation. And fourthly, the beauty of the island is being impaired. As an attempt to check these menaces the "Hill Lands Ordinance" has now been passed by the Straits Settlements Legislative Council, the methods of cultivating the various crops have been studied, and machinery for implementing the Ordinance with as little annoyance as possible to landowners has been set in motion.

Legislation.

Since the terms of the "Hill Lands Ordinance" do not seem to be generally known at present, it may be as well to describe its main features. The Collector of Land Revenue, by notification in the Government Gazette, may declare any land to be "hill land." Once this has been done the owner or occupier may not plant any short term crops whatsoever (bananas and pineapples are included specifically as short term), nor may he interfere in any way with any vegetation except with a permit from the Collector of Land Revenue. Such permits will only be issued for the cultivation of permanent crops, and will specify approved anti-erosion measures. Any further planting of short term crops on gazetted land will therefore be illegal, and once the present crops are harvested, the squatters will have to move, or be moved, elsewhere. It will be seen that very wide and drastic powers have been acquired to deal with an urgent situation: the application of them in practice will be watched with interest.

Land Tenure.

Most of the land is held under old East India Company Grants which impose no conditions. It is now almost entirely in the hands of Chinese and Chettiars, the majority of whom are business men in Georgetown; they rarely have time to visit their properties except during week-ends, so that most of the agricultural work is in the hands of mandors or agents and squatters. It is hoped that landowners will take advantage of the Ayer Itam Farm School to which they can send

their sons who will subsequently be able to manage the estates on sounder principles than at present. The squatters are increasing in number with alarming rapidity; some of them have been on the hill for years practising "shifting cultivation" of short term crops, others are now moving up as the young coconuts under which they previously planted tapioca come into bearing, and there has also been a big recent movement from land acquired by the War Office: furthermore, one war refugee from China has already been met, and there may be others.

Climate.

The average annual rainfall for Penang Hill is 128.05 inches of which 41 per cent. falls during the period September, October, November and 21 per cent. during March, April, May. During the former period in particular, erosion on a large scale may be expected unless very careful precautions are taken.

Soil.

The soil on most parts of the Hill is derived from granite weathered *in situ*. It contains a high percentage of coarse quartz which renders it open and friable: it is consequently very easily eroded when exposed, but if suitably covered it can absorb very heavy falls of rain.

Flora.

The natural flora of the Hill is now only to be found in the jungle comprising the forest reserves and water catchment areas. Parts of these areas grow only a few trees but are covered with a very dense growth of bracken which is also frequently found in rubber and abandoned agricultural land. The latter, however, more often reverts to lalang and Straits rhododendron mixed with Chinese bamboos left by squatters: through this thick growth sapling trees begin to appear after two or three years.

By far the most extensive crop is rubber; after this in a rough order of importance come fruit trees, mainly mangosteen and durian, cloves, vegetables, pineapples, tapioca, bananas, nutmegs, coconuts, tobacco, arecanuts, ginger and flowers. A survey of the areas under each crop is being undertaken to form a basis for the implementation of the Ordinance.

Individual Crops.

(a) Rubber.—

The quality of this crop varies widely: the worst is found on bracken land where either the bracken eventually kills the trees or if the bracken is eradicated, erosion is so serious before other covers can gain a hold that the trees are extremely poor and have most of their roots out of the soil. There are also many poor holdings infested with lalang and other natural covers of an undesirable nature. After these come holdings which have been continuously clean-weeded and those which have been planted on old clove or nutmeg stone-faced terraces: the former are mostly boulder strewn and heavily eroded, on the latter the terraces have generally not

been maintained, and the appearance of both is somewhat similar. At the other end of the scale there are some fine stands of trees now being allowed to revert to beneficial natural covers: an area of this nature on a European estate is probably as good as any seedling rubber in Malaya.

Terracing of a sort is practised on most holdings, even if the terraces are only tappers' paths, but in the majority of cases they are much too narrow and, not being horizontal, they serve as drainage and erosion channels. Where the volume of water becomes too great for the narrow terrace it overflows and starts a gully.

The aims of the cultivation permits to be issued under the Ordinance are to encourage good natural covers by selective weeding, to establish artificial covers where necessary, and to eradicate lalang. The latter has been successfully accomplished on one estate by the use of Assam forks on the contour strip method: a strip 6 to 10 feet wide is slashed and the material is spread evenly over the strip below thereby forming a cover against erosion; the lalang roots are then forked out and put to dry on the top of the leaves; the next strip up hill is then treated in the same way. Lalang grass is also tackled by the "chipping" method. It is probable that most holdings infested with bracken will have to be allowed to revert to natural conditions unless a particularly strong growing cover can be found to swamp it; the use of Eupatorium for this purpose was considered, but as it has not yet reached Penang it was considered inadvisable to introduce such a noxius weed intentionally.

(b) Fruit.—

Durian.—From the erosion standpoint this is the most satisfactory crop now grown on the Hill because there is a local supersitition to the effect that a cultivated durian tree will not bear fruit: consequently the only treatment is an annual slashing just before harvest to prevent the fruit being lost in the undergrowth. The trees thrive on fair to good soil up to 1,200 feet, but above this level and also on the poorer soil types premature die-back takes place. It would probably be a difficult crop to establish on eroded land which has been under short term crops for some time unless heavy manuring were undertaken; growth of young trees under similar conditions at Bukit Lima Kongsi in Province Wellesley has been very slow. There is, however, scope for extended planting of the crop in some areas.

Mangosteen.—This is a very popular crop: a few trees are found near almost every house, and small plantations exist in many places. The trees are generally planted on old stone terraces or on heavily eroded land. They are seldom cultivated except when lalang is hoed, and they yield a very variable crop.

Rambutan.—There are very few rambutan orchards on the Hill except at the lowest elevations. Clean weeding is the general rule with each tree on an earth-faced terrace, so erosion is usually serious. More enlightened growers are now adopting a system of ring-weeding: as the trees become larger the weeded circle gradually develops into an earth terrace, but the intervening spaces and banks are kept under a thick natural cover of grasses and herbs. Heavy manuring is necessary before remunerative crops can be produced.

Chempedak.—This crop is managed in the same way as durians.

Guavas.—Occasional patches of guavas are met with: they generally occur near squatters' houses, are unterraced, clean-weeded and give rise to serious erosion.

In future fruit trees will have to be grown with natural slashed covers or on terraces with stone or grass faced intervals.

(c) Cloves and Nutmegs.—

These two crops are taken together because they are cultivated in the same way. During the early part of the last century they formed the main export crops of Penang Island. They were grown on well-made wide terraces which were generally faced with stone, and must have covered two or three thousand acres by 1850.

In 1866, however, the nutmegs were almost annihilated by disease, and most of the plantations were abandoned until the rubber boom started; a few were put down to fruit, while here and there the original cultivation struggled on. Shortly after this disaster, the Zanzibar clove plantations began to make themselves felt on the world market and cultivation in Penang slowly dwindled.

These crops are always grown on terraces: sometimes each tree has its own, but more often they are grown in single rows on contour terraces varying from about 6 to 12 feet in width: the vertical interval between terraces varies from 3 to 10 feet. The usual practice is to clean-weed the whole holding, weathered soil from the terrace banks (if not stone-faced) being scraped down and worked in round the trees with manure; this latter practice in conjunction with erosion has gone on to such an extent that the roots of the trees on the terrace above are now in many cases exposed. As a rule the terraces are fairly horizontal but the backs of the terraces are used as drains for taking off surplus rainfall and where the outlets converge serious gully formation has already occurred.

Cultivation permits for these crops will aim at establishing natural or sown herbage on the terrace intervals, particularly on the top edges, and also at growing strips of cover across the terraces between the trees so as to check the flow of water along the back drains. With a decreasing amount of water flowing into the gullies it is hoped that natural vegetation will gradually block them.

Both crops require constant heavy manuring; prawn dust is generally used for this purpose, and a large tree may be given as much as 25 pounds per year; this quantity would cost about 60 cents in the plain, and must then be carried up to the plantations, most of which are at about the 1,000 feet level. Both trees are attacked by two or three species of twig and branch borers which may cause severe die-back: nutmegs also suffer from a fungus disease which brings about premature splitting and dropping of the fruit.

Holdings are usually small, and are worked by the owner living on the spot: he generally has a few acres of rubber in addition. Most holdings are heavily mortgaged, and in some cases foreclosures have been applied.

(d) Vegetables.—

Terraced vegetable gardens are mainly found concentrated on the hills around Ayer Itam where there is a wholesale market. No slope is too steep for the squatter who plants them; a steep slope merely means narrower terraces with deeper drops

between them (in the most extreme case observed the respective measurements were roughly 5 feet and 15 feet). Water is led to the topmost terrace from the nearest stream or spring by means of split arecanut trunks: tanks, frequently lined with cement, are constructed on each level, the overflow from one being led off to drop into the next. With a continuous flow from tank to tank and by arranging the pipes so that the jets fall into the centre of the tanks, mosquito larvae cannot breed, but breeding places are often caused by leaks in the conduits between stream and garden. Matted bracken roots, if present, are cut into bricks which are used to hold in the outside edges of the terraces.

On these terraces, constructed with a great deal of labour, are grown crops such as green celery, green peas, french beans and tomatoes which do not flourish in the plains: in addition garlic, mustard, long beans and cabbage are frequently found. The chief cultural difficulty is organic manure. No road runs nearby, the only livestock kept is poultry, and the task of carrying such bulky manures as cowdung up to 1,000 or 1,500 feet cannot be undertaken. The manufacture of compost would necessitate slashing nearby land, and exposing it to erosion. As a result most manure is applied in liquid form and is made by soaking prawn dust or soya bean cake in water for a week before application. Urine mixed with wood ash is generally used when making up new beds and night soil is presumably not thrown away. In spite of this, the soil in these gardens seldom attains a rich colour, and generally presents a "raw" appearance; fertility drops off considerably in the course of a few years and the area is then given a rest under natural covers for two or three years.

Vegetables, of course, come under the heading of short term crops, but it has not been definitely decided to gazette all market gardens as "hill land." It is possible that maximum drops and minimum breadths for terraces will be laid down. The erosion problem is very similar to that in the clove holdings. Loss of soil occurs to a certain extent through falls of earth from the vertical terrace banks, none of which are stone-faced, but more seriously from scour along the back drains which almost invariably have outlets into the same gully. As beds are generally raised leaving a definite drain at the back of the terraces, experiments are to be undertaken during the next rainy season using sections of tree boughs about 4 inches in diameter with a V cut in the centre to form blocks at frequent intervals across the drains; they should hold up the silt and check the water flow, at the same time allowing a certain amount of water through the Vs. It would be quite impossible to persuade the local squatter to grow grass or a cover in his drains.

(e) Pineapples.—

Although there is no pineapple canning factory in this part of Malaya there is a considerable demand for the fruit in the towns. The Georgetown supply comes almost entirely from squatters on the hills, particularly from the Batu Gantong and Relau districts. Conditions under which this cultivation first started are not known; nowadays an area of secondary "belukar" or bush on soil too poor for vegetables is chosen. The cover, consisting mostly of Straits rhododendron, is cut back and burnt

and the land is hoed into terraces 2 to 3 feet wide and not necessarily horizontal; the vertical interval depends upon the slope. The top soil and ashes are brought to the back of the terraces where the suckers are planted 2 to 3 feet apart. Rigorous clean weeding combined with scraping the terrace intervals is practised, with the result that after 12 to 18 months the plants are on the outer edge of the terrace instead of at the back; in this position they tend to hold up the soil for a time, but when after about 3 years they are hanging on by a few remaining roots, the area is abandoned for several years.

Erosion under these conditions is considerable; heavy rain beats on the terrace intervals, carries the eroded soil along behind the plants and forms small gullies in all weak spots. Furthermore, terraces are arranged in blocks between which deep gullies develop. As pineapple supplies can be obtained in Georgetown from some of the flat land in Province Wellesley, it is proposed to prohibit their further cultivation on Penang Hill after allowing one year for present crops to be harvested.

(f) Tapioca.—

This crop is being cultivated at an alarmingly increasing rate on the hills above Glugor, probably by squatters who have been turned off coconut estates. No attempts are made at terracing for tapioca; scrub, bush or jungle is cut and burnt, the land is hoed once, and cuttings are planted. Weeding is done regularly. Under such circumstances erosion cannot fail to be disastrous. Further cultivation will be prohibited.

(g) Bananas.—

Cultivation of bananas is not extensive, but parts of Batu Gantong have been planted with the crop for 15 to 20 years. Legislation or not, it will be impossible to continue for more than another 5 years because by that time what is left of the soil will have gone. Already in places there is nothing left but expanses of rock. The suckers are originally planted on unprotected terraces which are scrupulously clean-weeded. As time goes on small boulders are uncovered by erosion, and these are used to hold up for a while what is left of the soil. There is no case for allowing such cultivation to continue, but in rare cases where they are grown on stone terraces, no harm is done.

(h) Coconuts.—

There can be no doubt that the coconut does not flourish under hill conditions; nevertheless there are large numbers of palms both in small blocks and also scattered among rubber and fruit trees throughout the hill area. The one thing to be said in their favour is that they are generally surrounded by a ring of stones and boulders, inside which manure, either wood ash or prawn dust, is applied. Yields are negligible. Future cultivation is to be discouraged, and in many cases owners are being persuaded to cut out inter-planted palms so as to give the other crop more space to develop. One of the worst cases of erosion on the Hill was seen in a coconut estate at Paya Terubong where clean weeding is being practised with no terracing precautions, indeed it seemed as though old stone terraces had actually been broken down by the labourers.

(i) Tobacco.—

Cultivation is on the same lines as for vegetables; the area is small but satisfactory crops are harvested.

(j) Arecanuts.—

Apart from a large block on Brown Estates, the arecanut is grown as a sole crop on a negligible scale. Natural covers or terraces with covered banks will be stipulated in cultivation permits.

(k) Ginger.—

This is another minor crop, but important from the erosion standpoint because it is planted by much the same methods as pineapples and generally on very steep land. The terraces are even narrower than those used for pineapples.

(l) Flowers.—

Terraced rose gardens are quite common on a small scale, but erosion precautions are seldom taken. The crop is reported to be sufficiently remunerative to justify insistance on stone-faced terraces. Hydrangeas and dahlias are also grown in rotation in vegetable gardens near the hill railway; good returns are said to be obtained.

Conclusion.

As soon as the survey is completed, the first step in implementing the Hill Lands Ordinance will be an endeavour to remove all planters of the most dangerous crops, that is tapioca, pineapples, bananas and ginger, and to concentrate on prohibiting the cultivation of these crops in the future. The other most serious crop is rubber; in this case very valuable work has already been done by the Chinese Asiatic Rubber Instructor in dissuading growers from their allegiance to clean weeding and in demonstrating the advantages of the "forestry" method of management; this work will have to be followed up closely by the inspection staff. When these objectives have been attained, it will be time to consider the position of the remaining crops. In the meantime, with the exception of durians in a few cases, no alternatives to the short term crops can be suggested, but any propositions for planting permanent crops on the land will be carefully considered, and any approved schemes will receive constant watching and advice from the Department of Agriculture.

Summary.

Recent legislation to prevent erosion on Penang Hill is explained.

Conditions under which individual crops are grown are described with special reference to the erosion factor, and the methods by which it is hoped the latter may be countered are outlined.

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THE VALUE OF PLANT HORMONES OR THEIR SUBSTITUTES IN PLANT PROPAGATION

By
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The word "hormone" has long been used by animal physiologists to describe substances produced in one part of an organism and transferred to another part there to exercise specific effects on cells or tissues. They are of the nature of chemical messengers and although only produced in small quantities they have a marked influence on the correlation and differentiation of the organism. It is now known that similar substances exist in plants and to describe them the plant physiologist has made use of the terminology employed by the animal physiologist, although occasionally the prefix Phyto—is added to denote plant origin.

History.

The history of the discovery of hormones in plants dates back some sixty years and arose from investigations connected with the effects of light and gravity on the tips of the shoot and root respectively. With regard to the shoot it was shown that the bending of a seedling stem when subjected to lateral illumination was the result of a stimulus conveyed from the light perceptive tip of the shoot to a lower portion of the stem causing the latter to bend.

In the same way it was demonstrated that the tip of the root alone is gravitationally sensitive and that some influence is transmitted back to the adjoining parts resulting in their downward curvature. Nearly forty years later, carefully conducted experiments gave conclusive proof that the stimulus transmitted from the tip of a shoot to a lower portion of the stem was a material substance formed and secreted by the tip only, and at once the analogy with hormones of the animal kingdom became evident. It was shown also that growth of the stem is dependent upon an uninterrupted supply of this material substance to the growing region below the tip, and the growth promoting nature of the hormone was thus recognised. Since these discoveries were made, a large body of workers in many parts of the world have been investigating the occurrence, properties and functions of hormones in plants, and in consequence a considerable amount of information on the subject has accumulated.

From the horticultural point of view, the most interesting of these researches concern the effects of hormones on the growth of roots. Ten years ago it was demonstrated that an Acalypha cutting without leaves and buds formed few or no roots, but that a cutting with leaves and buds rooted profusely. It was subsequently established that this effect was due to a root-forming hormone produced in the buds and leaves. The occurrence of this hormone in plant tissues appears to be widespread. It has been found in rice polishings, wheat germ oils, cotyledons, pollen of many species, as well as in buds and leaves. Other experiments indicated

that the hormone is not specific since, for example, plants of tea, croton and papaya form mutually reacting root forming substances. It was also discovered that a root growth promoting substance existed in matter of animal origin particularly urine, and incidentally this is probably a contributory cause of the accelerated growth observed when stable manure is used as compared to the equivalent chemical fertilizers.

At this stage the chemical isolation and identification of the hormone was successfully accomplished. It was found to be an organic acid which could be readily synthesised in the laboratory.

Synthetic Hormones.

A number of synthetic substances chemically related to the root forming hormone were tested and found to be similarly active, and the advent of this knowledge marked the beginning of a number of experiments designed to test the effect of these substances on the root formation of cuttings. Among the most active of these substances are indole-butyric, indole-propionic, phenyl-acetic, beta-indole-acetic, and alpha-naphthalene-acetic acids, all of which are now commonly employed by investigators.

Factors Influencing Root Formation in Cultures.

For a proper appreciation of the rôle of synthetic substances it is necessary to bear in mind that the production of roots by cuttings, as in other biological phenomena, is the result of the operation of a number of independent factors and that only the optimum combination of these factors will be effective in inducing root formation. The factors known to exert an influence are either environmental or intrinsic to the plant material.

Of the environmental factors the constitution, acidity and temperature of the rooting medium are all of importance. Sand gives good results with many species although the practical propagator knows that some plants will strike better in other media, as for instance a mixture of sand and peat. A neutral medium is usually employed but in one instance—carnation—acidity produced by sulphuric acid had a beneficial effect although equivalent acidity induced by the addition of acetic acid had a detrimental effect. As regards temperature, experimental evidence adduced in temperate climates indicates that bottom heat in the propagating frames is usually necessary. There is no evidence however to show that the same is true in the tropics.

Light is another environmental factor demanding attention. It has occasionally been observed that leafy cuttings at the back of a propagating frame root more quickly than those at the front, and indeed experimental results would appear to indicate that the leafless cuttings of deciduous plants root best in darkness while leafy cuttings of evergreens require light to strike. The importance of moisture and aeration is universally recognised and do not therefore require emphasis.

The factors intrinsic to the plant material are less easy to control in experimental work and consequently the information concerning them is sparse. These factors,

however, jointly operate in producing that type of cutting which the experienced propagator recognises by instinct, as it were, to be suitable for propagation.

The variation between species, and even between varieties of the same species, with regard to the ideal type cutting for propagation purposes is considerable, and is doubtless responsible for much of the conflicting evidence reported in technical literature. For example, some plants strike best from soft-wood cuttings while only hard-wood cuttings can be used for the propagation of others. Age, presence or absence of leaves, and oil, resin and carbohydrate content of the cuttings are also variable factors known to exercise a profound influence on rooting ability.

Influence of Hormones in Root Development.

Root growth promoting hormone is another intrinsic factor operative in the production of roots by cuttings. A cutting that strikes without artificial treatment with natural hormone or equally effective synthetic substance, either contains the hormone when removed from the parent plant or, as is often the case with leafy cuttings in the presence of light, produces the hormone while in the propagating frame. It does not, however, necessarily follow that failure to strike is due to the lack of an available supply of hormone; it may be due to the absence or excessive influence of any one or more of the numerous factors known to promote root formation. In fact, treatment of cuttings with synthetic substances which are as active as the natural hormone has not resulted in stimulation of root formation in many species and in some has even had a depressing effect. Nevertheless, the list of species which have been shown to react positively to treatment with synthetic substances is already large and is continually being added to. The response to treatment by these species results in:—

(1) an increased percentage of rooted cuttings.
(2) a larger number of roots per cutting, and
(3) acceleration of rooting.

Practical Value of Synthetic Hormones.

One of the foremost workers in this field of research—Dr. M. A. H. Tinker of Wisley, England—has classified the plants tested by him into three categories—those rooting easily, those fairly difficult to propagate, and those very difficult to propagate—and found that 90 per cent. of the plants in the first group, 66 per cent. in the second group, and 8 per cent. in the third group, were stimulated by treatment with synthetic substances. From the nurseryman's point of view there is obviously no benefit to be derived from treating cuttings which are known to strike easily and quickly without treatment, but the use of synthetic substances has an immediate practical appeal in cases where by treatment "difficult" cuttings can be made to root freely. While efforts to strike treated cuttings of species offering the greatest difficulty have not so far met with marked success, the proportion of species offering medium difficulty which have responded to treatment is reasonably high, and the importance of this in nursery-work can be readily appreciated.

The possibilities of synthetic substances in horticultural practice, however, is not confined to the propagation of "reasonably difficult" species. Among the easy rooting class of species, 90 per cent. of which react to treatment, the gardener knows of many that take a long time to strike. The cuttings of a number of evergreens are typical of the "easy but slow rooting" type, and experiments with some of these have shown that whereas treated leafy cuttings strike within six to eight weeks, similar untreated cuttings may take more than twelve months to form roots. Trials with types other than evergreens, embracing a large number of species known to be "easy but slow rooting" have also demonstrated the superiority of treated cuttings, although it is questionable whether the accelerated rooting obtained in the case of some species would justify treatment on a large scale.

In one other respect synthetic substances promise to prove of value to the propagator. A considerable number of plants can be propagated easily and rapidly but only during particular seasons. By treatment with synthetic substances it is possible to propagate some of these plants out of their normal season, and the value of the treatment for such species is therefore dependent on the time of the year it is desired to propagate them.

It should be noted, however, that the positive responses to treatment so far obtained have been almost entirely confined to leafy cuttings; the recorded cases of response by leafless cuttings are few.

As regards after-effects, the general experience is that the treatment of a cutting with synthetic substance does not produce any deleterious effects in the plant subsequently established. In fact, with few exceptions, the initial advantage of accelerated and increased rooting gained by a treated cutting over an untreated cutting is fully maintained in the growth of the plant produced.

While it is evident that very material benefit may accrue to the nurseryman through the use of synthetic substances, they must not be regarded as a panacea for all propagation troubles. As has already been pointed out, synthetic substances do not by any means always cause a positive response, and before employing synthetic substances for striking cuttings of a particular plant on a large scale, it is advisable for the propagator to satisfy himself by preliminary trials that the additional cost and labour involved in treatment will be justified. As a matter of interest it might be mentioned that some commercial nurserymen in Britain have incorporated treatment with synthetic compounds in their normal routine propagation of certain species of ornamental plants.

Methods of Using Synthetic Hormones.

In the course of experimental work with synthetic substance three methods of treatment have been employed. The method which has given the most satisfactory results to date and which is now favoured by the majority of workers, involves standing the base of the cuttings in water diluted solutions for a certain time and rinsing them with water before insertion in the rooting medium. The optimum concentration of the solution and the optimum immersion period in the solution appears to vary widely from plant to plant, and for a particular species or variety

can only be ascertained by experimentation. Generally speaking, however, the greater the concentration the shorter the period of immersion, but if the concentration is too great the cuttings fail to respond and will decay.

Of the other two methods, one consists in watering previously untreated cuttings in the propagating frame with solutions of synthetic substances, while the other involves application of the active agent in the form of a mixture with lanolin paste to the cutting before placing in the rooting medium. Neither of these methods, however, has proved as successful as immersing the base of the cuttings in the solutions.

Chemical manufacturers early appreciated the possibilities of synthetic growth promoting substances in horticultural practice, and there are now several proprietary preparations on the market containing one or other of the active synthetic substances in solution.

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THE RELATION BETWEEN FROND TRANSPIRATION AND YIELD OF SAP IN THE NIPAH PALM *(NIPAH FRUTICANS)*

By

V. M. Hinchy, M.Sc., F.I.C.,

Late Distillery Manager, Nipah Distilleries of Malaya Ltd.

While studying the nipah palm as a source of sugar, the daily variation in yield of sap was discovered to be a problem of considerable importance. As may be seen from Table I. the average yield from day to day can vary by as much as 30 per cent. in a plantation of palms such as that situated at Kuala Selangor in Malaya. Under the system adopted on this plantation, a spathe was tapped once daily for a fortnight. The highest yield was obtained from spathes newly opened for tapping, the yield declining steadily throughout the period of tapping. In addition to this gradual decline in yield, however, there was a daily variation in yield which remained unexplained.

The plantation was supplied with an irrigation system and was not therefore entirely dependant on rain; yet it was evident that there was some relation between the flow of sap from the fruit spathe and the rainfall. It was especially noted that on dull days when the rain was light but continuous the yield of sap was abnormally high while heavy rain falling at night or for a short time during the day did not produce a proportional increase in yield. Further, variations in yield were found to be appreciable when the rainfall was zero or practically negligible.

The yield of sap from the spathe during the day consisted of about 30 per cent. of the total for the 24 hours. Table II. is an example of some tests on spathes of varying periods in tapping. While "younger" spathes would appear to yield a higher proportion of sap during the day the average yield was 28 per cent. by day and 72 per cent by night.

The essential differences between day and night is a difference in atmospheric temperature and humidity. If the day is one of bright sunshine and relatively high atmospheric temperature, and particularly if there are high winds, the humidity of the atmosphere is low and consequently the rate of transpiration from the fronds of the palms is high. Transpiration take place to a less degree when the day is dull and cloudy, temperatures are lower and the humidity of the atmosphere is comparatively high. In Malaya the temperature drops steadily from 5 p.m. to 7 a.m. and humidity increases from 65 per cent to about 95 per cent. during that period. Thus it appeared that relative humidity rather than rainfall was the controlling factor so far as yield of nipah sap was concerned. Relative humidity was directly related to frond evaporation—as the former decreases the latter increases and *vice versa*.

An attempt was made to obtain a measure of the actual evaporation from the fronds of the palms and accordingly an atmometer was installed in the plantation on a level with the tops of the palms. The atmometer consists simply of a porous

Table I.

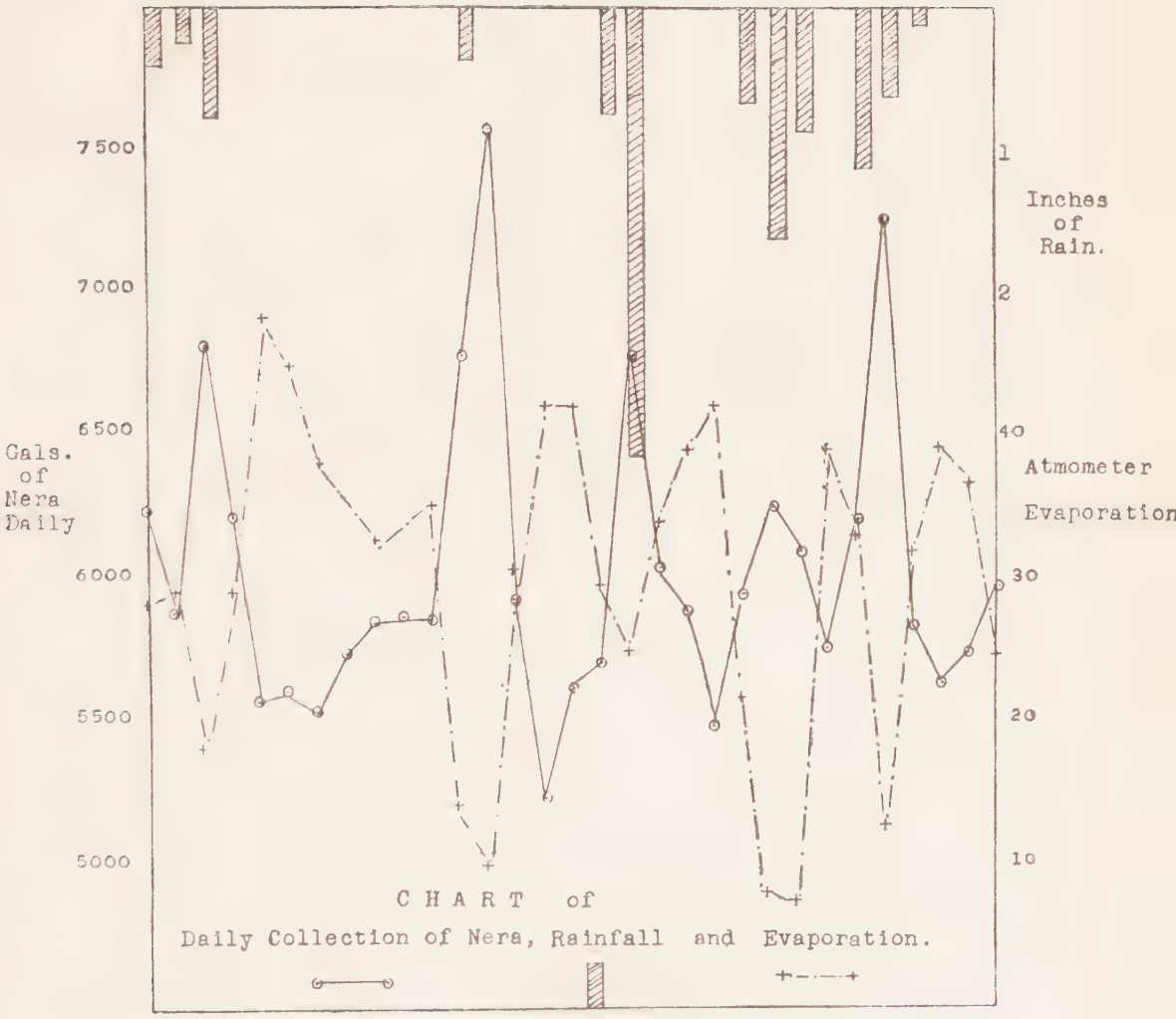
Field 13A. Variation in volume of Nera per Spathe 24 Hours collection.

Spathe No.	1	2	3	4	5	6	7	8	9	10	11	12	Total ozs.	ozs. per spathe.
Days in Tapping.	16	16	16	16	16	16	16	16	16	16	16	16		
26th Oct. ...	23	12	24	24	40	37	26	24	40	40	27	27	344	28.6
27th Oct. ...	19	9	16	17	30	20	20	22	36	30	10	20	249	20.7
28th Oct. ...	19	9	19	17	33	33	21	21	25	32	19	22	270	22.5
29th Oct. ...	16	6	15	14	33	30	21	20	37	29	21	20	262	21.8
30th Oct. ...	22	13	25	23	44	41	30	29	43	44	21	30	365	30.4
31st Oct. ...	12	6	17	12	35	28	20	20	36	30	15	22	253	21.1
1st Nov. ...	14	8	19	14	38	34	20	26	40	40	16	26	295	24.6
2nd Nov. ...	16	7	21	18	36	34	20	26	42	40	20	24	304	25.3
Average : ...	17.6	8.75	19.5	17.3	36	32	22	23.5	37.4	35.6	18.6	24	293	24.4

Table II.

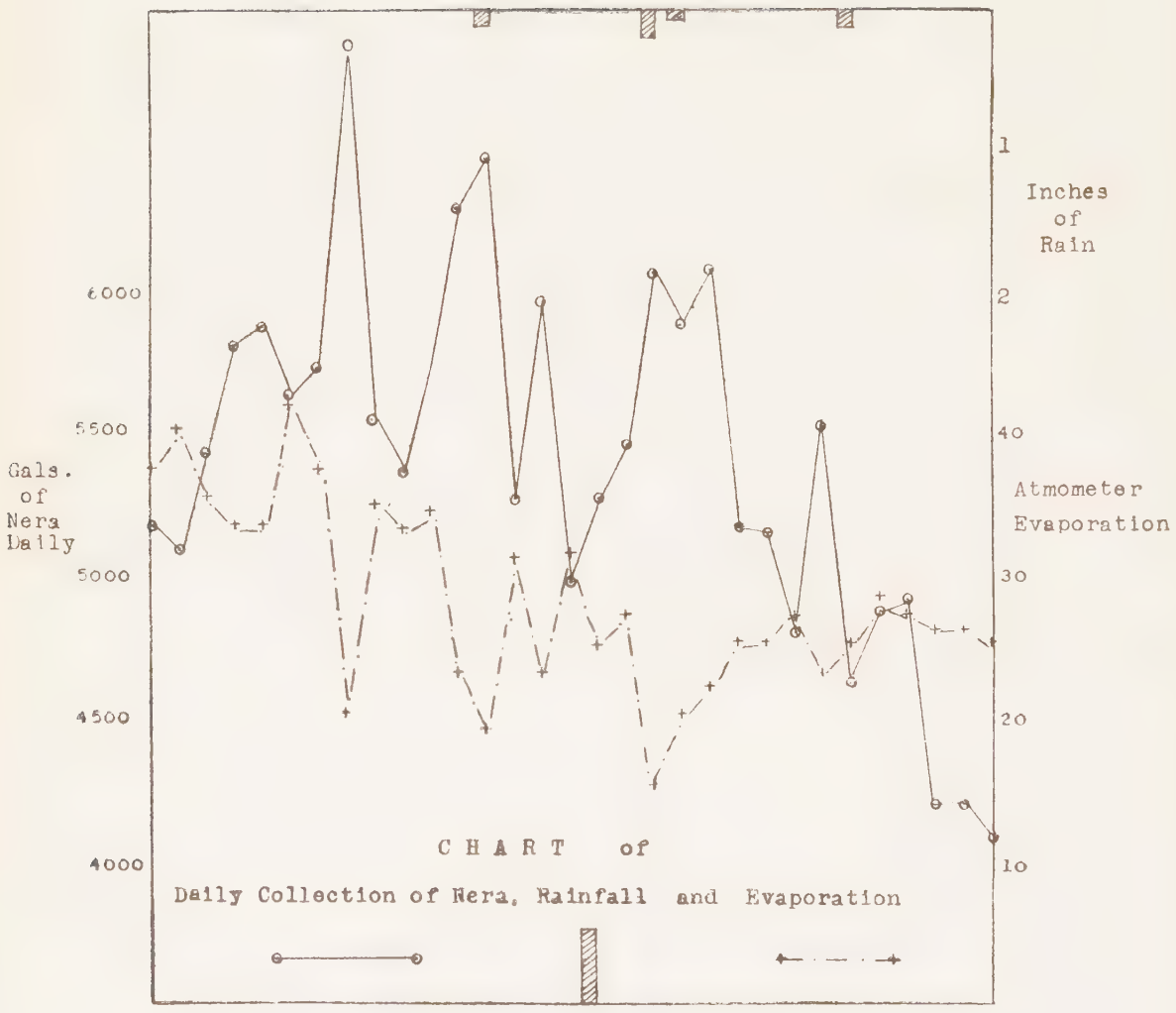
Field 11B.	Variation in volume of Nera per Spathe												Day and Night Collection.	
Days in Tapping. ...	30	15	15	15	15	92	45	92	15	45	60	15	Total ozs.	ozs. per spathe.
Day ...	7	7	4	7	9	12	16	4	7	9	5	6	93	7.75
Day ...	7	5.5	3	6	8	10	14.5	1	6.5	3	4	5	73.5	6.0
Average ...	7	6.25	3.5	6.5	8.5	11	15.25	2.5	6.75	6	4.5	5.5	166.5	6.87
Night ...	16	12	7	14	17	31	40	10	10	27	10	14	208	17.03
Night ...	18	11	5	15	20	31	43	10	12	22	11	14	212	17.6
Average ...	17	11.5	6	14.5	18.5	31	41.5	10	11	24.5	10.5	14	420	17.5
Percentage Day ...	29	35	37	31	31	26	27	20	38	20	30	28	28	
Night ...	71	65	63	69	69	74	73	80	62	80	70	72	72	

Chart I.



January 1937.

Chart II.



August 1937.

clay pot connected by a glass tube with a bottle of water. The quantity of water evaporated daily from the porous pot is measured from a graduated cylinder used to refill the bottle. Graphs of the rate of evaporation and the yield of sap from the area of about 500 acres were compared and proved most interesting. Continuously for a period of about 18 months the relation was checked so that it was possible at 7 a.m. to forecast very closely the yield of "nera" (sap) from the estate for the day. Delivery to the factory was completed at about 1 p.m.

Charts I. and II. are reproduced as examples of the results obtained. During the month of January 1937 (Chart I.) the rainfall was considerable but the transpiration as recorded by the atmometer gave a much better indication of the yield from day to day and "explained" the rise and fall in yield. In August 1937 (Chart II.) the rainfall was almost negligible yet the peaks and troughs of the curves coincided in a remarkable manner.

It is obvious that a nipah plantation so sensitive in its output to variations in atmospheric humidity should not be exposed to brilliant sunshine and high winds and that to obtain a maximum and consistent yield of sugar-bearing sap, conditions of high humidity are essential. Shade trees and wind breaks should be provided, not so dense as to exclude light and air which are so necessary for fruiting yet sufficient to disseminate the rays of the midday sun and to protect the palms from the full force of the drying winds. Inter-planting of coconuts with the nipah palms is no doubt the best solution of the problem and there is little doubt that under such conditions the yield of sap from the nipah palm would be maintained at a high level and the average production for the month made considerably more profitable.

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Selected Article.

THE COMMERCIAL PRODUCTION OF SUGAR FROM THE NIPAH PALM[1]

By
Victor M. Hinchy, M.Sc., F.I.C.

Nipah (*Nipah fructicans*) is a type of trunkless palm indigenous to the Philippines, Borneo and Malaya. The flower stalk rises from the ground, grows to a height of 4 to 5 ft., and produces a fruit which matures in about six months. The sugar juice is obtained by removing the fruit and hanging upon the end of the stalk of a small earthenware pot. Provided that the wound is kept open the flow of juice continues day and night for about three months till the stalk has been completely cut away. Inversion and fermentation of the sucrose is avoided by the use of preservatives and the juice is collected for transport to the factory daily. Factory treatment follows mainly the established methods for sugar production, and the nett result is sugar to all intents and purposes indistinguishable from that obtained from other natural sources.

Advantages of its Production.—The commercial production of sugar from the Nipah palm is a new industry which would appear to hold out decided advantages over beet or cane. The outlay of capital, which is essential for the planting of beet and cane, the former yearly and the latter yearly also or at intervals of a few years, is a considerable item constantly recurring in the table of costs. In comparison the Nipah palm once planted continues to yield indefinitely. No evidence of natural decline or death of the palm has been discovered, while its constant multiplication of palms or "stands" actually necessitates periodic thinning out to maintain fruiting at the maximum.

Under plantation conditions in Malaya the palm has been found to flower and fruit throughout the year, so that manufacture of sugar can proceed continuously instead of for a comparatively short season, as is the rule with beet or cane. It is of no small importance at the present day that all the staff and labour of a Nipah plantation and factory are kept in constant employment.

For a certain yearly output the plant of a Nipah factory may be less than half the size of that in a cane or beet factory. Not only is there a reduction in the size of the boiling-house unit, but no extraction plant is required to obtain the sugar juice, a tremendous saving in initial and running costs compared with those factories which must use expensive diffusion batteries or cane mills. The losses of sucrose, which are inevitable and sometimes considerable during extraction from the raw

[1] Extracted and published in the *International Sugar Journal* 1938, 40, pp. 301—303 from a monograph bearing the same title published privately (in mimeograph form) by the author, copies of which have been presented to the principal technical libraries in London, New York and Washington.

material by battery or mills, are automatically eliminated and the juice enters the Nipah boiling-house with 100 per cent. of its original sugar.

With a distillery operating side by side with the factory the proportions of sugar and alcohol can be varied to meet market requirements, since production of alcohol from the raw material is even simpler and more direct than from the factory molasses and cheap, since no preservative is then introduced into the collecting pots on the fruit stalks.

Nipah Plantation in Malaya.—The only plantation of Nipah palms in the world at present is located at Kuala Selangor in the Federated Malay States. It comprises 1,900 acres owned by the Nipah Distilleries of Malaya Ltd., 700 acres held by this company under a Temporary Occupation Licence, and 200 acres retained by the Government as a Malay reserve. All the palms are now mature and preliminary tapping over an area of some 500 acres for a period of about four years has given opportunity for the collection of data and the establishment of methods of cultivation, tapping and collection of the sugar juice from the palm. At a point on the plantation convenient for river traffic there has been erected a distillery capable of producing yearly some 2,000,000 galls. of 95 per cent. alcohol, and a small factory in which the system of manufacture of sugar from the Nipah juice has recently been worked out. This factory at present has a capacity of about 1,500 tons of sugar per annum.

The original intention was to produce power alcohol from the Nipah juice for use in Malaya but political difficulties made this project impossible, and it was then decided that sugar should be the main product, sufficient alcohol only being distilled to supply the local demands for methylated and rectified spirit and for potable liquors.

Production previous to 1934.—GIBBS[2] described some laboratory experiments made in 1911 on the production of sugar from Nipah juice in the Philippines. Twenty new bamboo joints were coated inside with a thick mixture of lime and water and placed in position on the fruit stalks at 6 p.m. At 6 a.m. next day the juice which had flowed during the 12 hours was collected in a glass demijohn and transported to Manila. It was filtered 28 hours after collection, the clear filtrate measuring 15 litres (31.68 pints). Four litres of the juice were heated to boiling in a large porcelain evaporating dish, and carbon dioxide gas run in until the alkalinity was reduced to 0.10 grm. CaO per 100 c.c. of solution. This solution was then filtered and analysed.

The process of evaporation was continued, and alkalinity further reduced with sulphur dioxide to 0.01 grm. CaO per 100 c.c. of liquid. This solution was again filtered and analysed. On boiling down to a massecuite and cooling, crystals of good grain were obtained, these on drying in a hand centrifuge and finally in an air oven at about 90° weighed 157 grms. were pure white and polarized 96.8 per cent.

[2] *Philippine Journal of Science*, A.6, 1911, p. 141.

Wells and Perkins[3] used a crude vacuum evaporator in 1922 to concentrate some Nipah juice which had been preserved with lime and afterwards treated with compressed carbon dioxide gas. They boiled down 844 litres of juice and obtained 67 kilos. of sugar polarizing at 87°. They stated that no difficulty was found in refining a portion of this sugar to a pure white product.

Pending further investigation they recommended small scale plants requiring but small investment. They stated "the use of open pans instead of vacuum apparatus makes the boiling-house inexpensive, but the replacement of a large scale carbonatation equipment by home-made apparatus is more of a problem. The Indian method of using so little lime that it need not be removed does not seem efficacious in Philippine Nipah swamps, so carbonatation or some equivalent process must be employed."

Production in 1934.—When the writer visited Malaya in November, 1934, sugar production of a very crude and primitive type was in operation on the palm plantation. Preservation of the juice during the 24-hour period of collection from the palm was incomplete, there being in use only a badly burned shell lime, produced on the estate. Removal of this lime at the factory by heating, settling and the addition of a small quantity of phosphoric acid was not complete and a highly alkaline liquid was being sent on to the evaporators for concentration to syrup. Evaporation was being carried on under atmospheric pressure in open coil pans of considerable dimensions, and final concentration was being obtained by boiling small quantities of syrup for long periods over open wood fires. The massecuite was left to crystallize in wooden boxes for some days and then centrifuged. The sugar was spread out on copper-lined tables to dry in the sun.

Preservation of Raw Material.—The Nera or juice as it drips from a freshly tapped stalk or spathe is slightly alkaline in reaction and is thus an unfavourable medium for the growth of organisms. However, if no means of preserving the Nera is applied, local yeast and bacteria and possibly enzymes in the Nera itself rapidly infect the sugar liquor, causing inversion of the sucrose and subsequent fermentation to alcohol.

The problem of discovering a suitable preservative for the Nera had been engaging the attention of the Malayan Department of Agriculture for a considerable time. They experimented with such preservatives as sodium fluoride, sodium sulphite and bisulphite, copper sulphate and acetate, alcohol, etc. Though these compounds were effective to varying degrees, they were not practicable for sugar manufacture. Eventually it was decided that thick lime solution was the most suitable from the factory point of view.

Thus it happened that the writer arrived in Malaya to report on Nipah sugar production equipped with samples of electrolytic chlorine and "Perchloron."

Both the electrolytic chlorine and the "Perchloron" were found to be excellent preservatives if doses were given twice daily, but on the score of economy it was decided to use the chlorine disinfectant during the day only, and to add a lime

[3] *Philippine Journal of Science*, 1922.

solution made from a good stone lime to the pot to prevent inversion during the night. The quantity of lime added was thus considerably reduced and this was afterwards removed without difficulty in the factory.

Transport of Nera.—Transport of the Nera in the older areas in tapping was from the tapper's bucket to large earthenware jars (where the quantity per task was checked), then to bronze-lined punts on canals, and finally through electric pumps to tank cars on the main railway line. As newer areas were opened up side lines at right angles to the main line divided the fields into blocks of about 20 acres each, and the Nera was transferred direct from the earthenware jars to the tank cars standing on these side lines. Internal combustion locomotives using Nipah spirit conveyed the cars of Nera rapidly to the factory.

Factory Practice.—The next and extremely important problem was the removal of the excess lime and the production of a clarified juice as nearly neutral as possible for supply to the evaporators. To neutralize the whole of the lime with sulphur dioxide, phosphoric acid or other clarificants would have been extremely costly and the bulkiness of the precipitate would have rendered subsequent treatment of the muds extremely difficult. Accordingly, as the result of laboratory experiments, a system of double heating with 1st and 2nd subsiders was arranged. In the first subsiders the raw Nera was heated by closed coils to a temperature of 68°C. and allowed to subside. A heavy precipitate containing most of the lime added in the field settled out at this stage, and clear amber-coloured liquid, still alkaline, *pH* about 9, was drawn off by cocks at the side.

This first subsider juice was pumped to treating tanks where phosphoric acid in the form of double concentrated superphosphate was added to reduce the *pH* to about 7.2. The treated juice was then pumped through the juice-heater and discharged to the second subsiders at a temperature of about 98°C. Subsidation was very rapid and the muds formed a compact mass less than 10 per cent. of the total volume. The clear juice from the second subsiders, still slightly alkaline, passed direct to the evaporator.

The muds from the first and second subsiders were sent together to the mud tanks where they were blown up with live steam, a small quantity of phosphoric added to reduce the alkalinity, and allowed to settle. About 50 per cent. clear liquor was drawn off and returned to the first subsider clear juice tank, and the muds were finally further diluted and sent to Taylor filters.

In India it was found that Palmyra palm muds filtered slowly and with great difficulty through pressure filters, and as the Nipah palm muds were similar, Taylor filters were preferred to the more usual type.

The vacuum evaporator installed for the new factory was a triple effect of the Harvey type; operation was simple and concentration most effective. In the preliminary laboratory experiments the problem of eliminating the Nipah "tang" during manufacture was an exceedingly important one as it was obvious that the finished product to obtain a ready market should have no characteristic flavour to associate it with Nipah. It was found, however, that by evaporation under vacuum those

nitrogenous compounds which gave a special flavour to the raw and clarified juice passed over with the water vapours, and left a syrup to all intents and purposes neutral in flavour and indistinguishable from ordinary cane syrup.

The syrup was subsided as usual and then boiled in a coil vacuum pan, seed being drawn in, and boiling carried out in the usual way. Due to the high ash content of the original Nera it was considered advisable to keep the temperature of the massecuite at about 150°F., using steam at 20 lbs. pressure and occasionally high pressure steam (50 lbs). A small quantity of stannous chloride was drawn to the pan shortly before finishing, and the resulting sugar cured after 8 hours in the crystallizers was light in colour, pol. about 96° and a free though small grain crystal. The first molasses was re-boiled, shock seeded with powdered white sugar, and cured after three days at rest in the crystallizers. This grade of massecuite also cured fairly freely to produce a marketable sugar. The final molasses was sent to the distillery.

Unfortunately, early in 1936, the duty on Empire sugar of 3 cents per lb. was removed completely and that on foreign sugar reduced from 5 to 2 cents per lb. This had the effect of reducing the market price of Nipah sugar from $8.10 per picul (133⅓ lbs.) to $4.50 per picul. Sugar manufacture was terminated immediately and all Nera was sent to the distillery.

Some months later the F.M.S. Government offered to subsidize the factory to the extent of 3 cents per lb. of sugar manufactured up to a limit of $50,000 per year for three years. Sugar production started again in November, 1937, and though the crop had been seriously affected by a persistent drought the output of sugar was good and the boiling-house recovery well maintained.

It was obvious, however, that while production remained far below the economic limit it was unprofitable to continue manufacture, and that unless funds were available to bring into tapping large areas of Nipah, the concern could not continue to function, and attempts to raise further capital proving abortive, it was decided to close down the Estate on 28th February, 1938.

Reviews.

Annual Report on the Departments of Agriculture, Malaya, for the year 1937.

By O. T. Faulkner, C.M.G., B.A. *Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States. Government Press, Kuala Lumpur, F.M.S. 1938. 81p.p. Price $1 (Straits currency) or 2s. 4d.*

The subject matter of this annual report on Malayan agriculture is arranged in a similar manner to its immediate predecessors, namely, in Section I is given a general account of agriculture during the year, and in Section II an account of the work of the Department of Agriculture.

It is, of course, only possible in the compass of the 38 pages which comprises Section I to give a "bird's eye" view of agricultural conditions in 1937. The reader will find, however, that all important facts are included, are concisely stated and adequately supported by statistics. It is noticeable that the Director confines his report strictly to statements of fact and only draws conclusions or makes comments thereon when such are clearly necessary.

The second section of the Report, under the heading of "Work of the Department of Agriculture," consists essentially of the condensed annual reports of the Branches and Divisions of the Department.

In previous years it has been customary to publish the condensed Branch and Division Reports with the Director's Report and also to publish the unabridged Reports as a separate volume. This is now considered to be unnecessary duplication of information and in consequence the separate publication has been discontinued. It has been arranged, however, that a copy of the Director's Report will be issued to each annual subscriber to the series of Special Bulletins of the Department, so that those who wish to be kept in touch with the work of the Department may, as hitherto, be placed in possession of all the available published information of the Department.

Reports of the Field Branch for the year 1937.

Special Bulletin, General Series No. 30. Department of Agriculture, Straits Settlements and Federated Malay States. 171 pp. Price 50 cents (Straits currency) post free.

This volume of 14 annual reports places on record the work of the Field Officers of the Department of Agriculture, who are responsible for what is known in these days as the "extensional" work of the Department, *i.e.*, the application of the results of research work. In addition, as is shewn in these Reports, the Branch carries out a considerable amount of experimental and statistical work in collaboration with the Research Branch—particularly in relation to padi, but also with other crops—and investigations concerning the acclimatization of crops and the testing of varieties likely to prove suited to local conditions.

The present volume includes reports from three sources hitherto not represented in this compilation, *viz.* those of the Agricultural Officer, Brunei and Labuan, and the Report of the Canning Officer. Brunei and Labuan has now a resident Agricultural Officer, and the interesting summary of local conditions and of his work in these less known areas show that much useful work towards the improvement of the conditions of local agriculture is possible in these territories. The Report of the Canning Officer is included in this place for the sake of convenience. His work is mainly on pineapple research, but he is attached to the Field Branch and is stationed in Johore.

The reviewer has had occasion to study these reports carefully and has been impressed with the varied methods by which the officers concerned have devised and applied instruction to suit the needs of particular areas. In the "old days" a great deal of the time of the Field Officers was taken up in routine inspection of small holdings under the various Enactments, which resulted, where necessary, in prosecutions of small-holders.

Such a policy was dictated by the exigencies of the situation at that time and by the fact that the officers had large areas to control and therefore little time for instructional work. Happily the present larger cadre of Field Officers and the more thorough training of their subordinate staff at the School of Agriculture, Malaya, has rendered possible this change of policy, a change which is proving to be more effective than the old system of compulsion.

There is ample evidence in these Reports that the work of the Field Branch is attracting increasing attention amongst Asiatic planters.

D. H. G.

Miscellaneous.

REPLANTING AND MALARIA.

The Malaria Advisory Board invites the attention of all concerned with the management of estates to the danger of malaria resulting from the replanting of rubber. This danger is greatest in hilly country where the removal of old rubber provides ideal conditions for prolific breeding of *Anopheles maculatus*. Not only is there a great increase in breeding in streams and drains, particularly when these become blocked by trees being felled across them, but pits left by the uprooting of trees, holes prepared for replanting, silt pits and backward sloping terraces may all provide ideal breeding places.

It is suggested that, where possible, streams and drains should be put in order before felling and care taken to avoid blocking the drains by fallen timber. Pits left by the uprooting of old trees should be filled immediately if they are liable to retain water, and holes prepared for replanting should not be left open longer than is absolutely necessary. The Rubber Research Institute of Malaya advises that: "There is no necessity to leave the holes open for any longer than is necessary to check the actual work of digging them." (*The Planter*, September 1938). In many places silt pits and terraces are liable to retain water and measures should be taken to enable this to drain off. With the growth of cover plants such breeding places may become obscured, but are still a source of danger.

These measures should not be confined to a half mile radius from human habitations. When intensive breeding is allowed to develop beyond the half mile limit the value of anti-malarial measures in the controlled area may be largely nullified.

(*The above note was prepared by, and is published at the request of the Malaria Advisory Board, F.M.S.—Ed. M.A.J.*)

Departmental.

FROM THE DISTRICTS.

September, 1938

The Weather.

In Kedah the abnormally wet weather continued. The heavy rain in conjunction with high tides caused flooding of the Muda River during the last week of September. There were also local floods in other parts of Kedah. In Penang, Province Wellesley, and Perak the rainfall was also rather above the average. The remainder of the Federated Malay States and Malacca experienced some showers but the weather generally was rather dry and water supplies in some parts were short.

In Kelantan and the northern parts of Pahang a normal amount of rain fell.

In Johore and Singapore as a whole the rainfall was about average, though there were local variations and some places were very dry.

Crop Reports.

Rubber.—The market price of rubber remained fairly steady though the threat of war in Europe caused a depreciation towards the end of the month. Smoked sheet was valued at between $29 and $34 per picul. In Penang the news of the crisis in Europe on the 29th caused a sharp fall in price of rubber of $7 to $8 per picul.

Although rubber is now commanding a good price, the last month has not seen any great increase in tapping by small rubber-land owners. Tapping and selling rubber without coupons is not attractive to the average small-holder at its present value of $5 to $7 per picul.

Rubber Grading Schemes.—Although it is as yet too early to decide as to the economic result of the grading of small-holders' rubber, there have been some indications of the progress of the scheme in different parts of the country. In Pahang, for instance, dealers have co-operated whole-heartedly with the Department of Agriculture in operating the scheme and the quality of smallholders' prepared sheet has materially improved. It has been suggested that in this State dealers are few and competition is not acute, so that they are able to impose cuts on poor quality sheet without losing business. In Perak, where the scheme has been only lately initiated, there are many dealers and much competition exists among them. It is said that although they exhibit a board of samples and prices, in accordance with instructions, small notice is taken of it and there is little difference in the price received for good and bad quality sheet.

Dealers in Selangor seem definitely antipathetic towards the scheme and a trial grading of rubber by the Asiatic Rubber Instructor has not proved a financial success.

Padi.—It is too early to assess the amount of damage done to the growing padi by the floods on the coastal plain in Kedah.

In Province Wellesley and Perak cultivation made good progress during the month though the water was excessive in some places. Some delay and inconvenience has been caused to cultivators owing to the destruction of nurseries by floods during August. In other parts of the country local scarcity of water supplies occurred; and in Pahang owing to the dry weather, the planting schedule is generally behindhand.

Two new mills commenced work in Province Wellesley. It is reported that the large established mills are to form a combined fund for the purpose of buying up and eliminating their numerous small competitors.

Final figures for the yield and distribution of selected seed from seed farms in Malacca are now available. They show that a total of 9,290 gantangs of seed was produced, of which 2,820 gantangs have been distributed.

The only considerable distribution has been made in the Southern (Jasin) District. This apparent lack of support is actually due to the fact that in the Northern and Central Districts the use of seed of approved varieties is already widespread and most cultivators therefore have their own supplies.

Bananas.—For many years banana growing has occupied an important place in the agriculture of Negri Sembilan and in Jelebu and the undulating inland hill areas there are very large tracts planted with this crop. These areas are invariably clean-weeded, erosion is extensive and loss of fertility rapid. Such land is occupied on Temporary Occupation Licence. After a few years, when the land is exhausted and a paying crop is no longer obtainable, the cultivator abandons his holding which rapidly becomes overgrown with lalang grass. Large areas of such lalang-covered hills can be observed in this part of the country.

Maintaining the fertility of land alienated for banana growing naturally has caused much concern to Government but considerable difficulty has been experienced in devising any method to prevent erosion owing to the nature of the crop, the method of cultivation, the antipathy evinced by the landholders and the fact that the rather low profits realized leave no scope for manuring or expensive anti-erosion measures.

Trials have lately been carried out with various types of cover plants and *mikania scandens* has so far been found to be the most suitable. A start has now been made with the distribution of cuttings to banana growers and it is hoped to induce every grower to establish this cover. Compulsion may be necessary if occupiers of steep land refuse to take the measures of erosion control recommended.

Efforts have been made to cause old abandoned land to revert to jungle, but these efforts have so far been fruitless as in dry weather these lalang areas are frequently swept by fire which kills any jungle vegetation which may have become established.

Applications have been received for some of this land for rubber planting but much of it is considered to be too steep for re-alienation.

DEPARTMENTAL NOTES.

Transfer of Mr. O. T. Faulkner, C.M.G., B.A.

Mr. O. T. Faulkner, C.M.G. Director of Agriculture, Straits Settlements and Adviser on Agriculture, Malay States, relinquished duty of these posts on 23rd September 1938, by reason of his appointment of Principal, Imperial College of Tropical Agriculture, Trinidad.

Mr. W. N. C. Belgrave, Chief Research Officer, has been appointed Acting Director of Agriculture, S.S. and Adviser on Agriculture, Malay States, from 24th September 1938 inclusive.

Paper on Tea Planting in Malaya.

Mr. B. A. Lowe, Agricultural Officer, Cameron Highlands, delivered a paper on Tea Planting in Malaya at the annual Conference of the Incorporated Society of Planters held at Penang on 23rd, 24th and 25th September, 1938.

Mr. Lowe's paper, and the other Papers read at the Conference, together with the Discussions thereon will be published in the September number of *The Planter*, price $1 or 2s. 4d. to be obtained from the I.S.P. Headquarters, Kuala Lumpur.

Destruction of Squirrels.

The campaign organized by the Department for the destruction of squirrels in Malacca has terminated for the year. It is announced that 66,480 squirrels were destroyed, a satisfactory result which should be of material benefit to owners of coconuts and fruit plantations who are the chief sufferers from this pest.

Leave.

Mr. J. W. Jolly, Agricultural Officer, returned from leave on 27th August, and assumed duty as State Agricultural Officer, Perak, from 31st August 1938.

Mr. H. N. Sands, Agricultural Officer, is acting State Agricultural Officer, Selangor, during the absence from the State of Mr. C. L. Newman.

Mr. A. de K. Frampton, Agricultural Officer, has been granted 217 days leave from 17th June 1938 to 19th January 1939, both days inclusive.

FERTILIZER PRICES, SEPTEMBER, 1938.

The following are the prices at the end of September, 1938,† of some of the more important fertilizers.

Product.	Analysis				Price per ton $
	Nitrogen (N)	Phosphoric Acid (P_2O_5)		Potash (K_2O)	
		Soluble	Insoluble		
Sulphate of Ammonia ...	20.6	—	—	—	72.75
Calcium Cyanamide ...	20.6	—	—	—	80.00
Muriate of Potash ...	—	—	—	50	112.00
Sulphate of Potash ...	—	—	—	48	112.00
Superphosphate (concentrated) ...	—	39 - 40	—	—	105.00
Superphosphate ...	—	16 - 18	—	—	60.00
Basic Slag ...	—	16	—	—	48.00
Rock Phosphate (Christmas Island) ...	—	11*	38‡	—	33.50
Rock Phosphate (very finely ground Gafsa) ...	—	11*	26 - 28‡	—	40.00
Lime ...	—	—	—	—	20.00

* Citric soluble. ‡ Total.

Quotations are *ex* warehouse, Port Swettenham, Klang, Singapore and Penang, with the exception of muriate of potash which is *ex* warehouse, Port Swettenham, Klang and Singapore.

The above quotations for concentrated superphosphate, superphosphate and Christmas Island phosphate are *ex* warehouse Penang, Port Swettenham and Klang. The Singapore quotations for these three fertilizers are $95, $50 and $31.50 per ton respectively.

†Certain increases of price were announced during the last week of September, but were cancelled in 2nd October.

Statistical.

MARKET PRICES.

September, 1938.

General Conditions.

For most agricultural products, local market prices were steady or appreciated slightly in September. Rubber was adversely affected by the European crisis, but rapidly recovered. Pearl sago jumped from $2.17½ to $3.85 per picul owing to small supplies and good enquiry. The pineapple market awaits the coming into operation on 1st October of the Central Selling Agency; in the meantime, prices are nominal. The market for both copra and palm oil has still further declined.

Table I.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, September, 1938.

(Dollars per picul of 133 1/3 lbs.)

Grades	Kuala Pilah, Negri Sembilan				Kuala Kangsar, Perak	Batu Pahat, Johore.			
	1	8	15	29	21	7	15	21	29
Smoked Sheet ...	33.50	33.30	33.00	28.00	33.00	31.70	—	—	—
Unsmoked Sheet ...	—	32.00	31.91	22.00	—	30.80	30.50	30.54	24.83
Scrap ...	No purchases								

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

No purchases at Kuala Pilah on 22nd, or at Kuala Kangsar on 7th, 14th and 28th September.

Major Crops.

Rubber.—Singapore prices varied around 26 and 27 cents per lb. until the last few days of the month, when the serious political situation in Europe caused a decline to the lowest point of 22 5/8 cents on 27th. On the last day of the month, with news of a European settlement, the price recovered to 27½ cents per lb. The average Singapore price for No. 1. X Rubber Smoked Sheet, loose was 26.21 cents per lb., as compared with 26.56 cents in August. Prices on the London market were less affected by the political situation the highest price during the month being 8⅛d. and the lowest 7⅞d., the average price being 7.92d. as compared with 7.85d. per lb. in August. The New York price averaged 16.04 cents gold per lb. as compared with 16.01 cents gold in August.

Prices paid for small-holders' rubber at three centres during September are shewn in Table I.

Palm Oil.—Prices declined still further over those ruling in August. The average of weekly quotations per ton in August were: palm oil £14.2.6, kernels £8.7.6; prices for September are shown in the following table.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1938.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
September 2	£ 12. 0. 0 Liverpool	£ 8. 5. 0 Continent
,, 9	No information	No information
,, 16	13. 5. 0 Canada	8. 7. 6 London
,, 23	12. 10. 0 ,,	8. 5. 0 Rotterdam
,, 30	13. 5. 0 ,,	8. 5. 0 London
Average September	£ 12. 15. 0	£ 8. 5. 7½

Copra.—Singapore prices still showed a downward tendency, especially towards the end of the month. Sun-dried averaged $3.25 per picul and the Mixed quality $2.93 per picul, as compared with $3.43 and $3.08 respectively in August.

Copra cake was quoted throughout the month at $2.05 per picul.

Rice.—The average Singapore wholesale market prices of rice per picul in August were as follows:—Siam No. 2 ordinary $4.34, Rangoon No. 1 $3.82, Saigon No. 1 $4.05 as compared with $4.39, $3.92 and $4.02 respectively in July and $4.79, $3.92 and $4.12 respectively in August 1937.

The average retail prices in cents per gantang remained unchanged at Singapore 28, Penang 32 and Malacca 28.

The average declared value per picul of imports during August was $4.00 as compared with $3.91 in July and $3.97 in August 1937.

Padi.—In the main padi-growing areas the price of padi was slightly easier, generally from $8.50 to $9 per 100 gantangs. In more remote districts the price tended to rise, the quotations varying from $10 to $14 per 100 gantangs.

The Government Rice Mills in Krian paid $2.10 per picul for padi, and the Government Mill in Pahang from $2 to $2.25 per picul.

It is reported from Kedah that during the international crisis at the end of the month there was a heavy export of padi from the State and prices advanced 20 cents per bag of 28 gantangs.

Pineapples.—Packers are forming a central selling scheme and pending formation of this, values are nominal. The scheme aims at a price of $3.10 per case of 1½ cubes from 1 October. The Agricultural Officer, Singapore, states that the following prices per case were quoted:—G.A.Q. Spiral cut $3, Round cut $3.50, Cubes $3.00; Golden quality $3.20, $4.00 and $3.20 respectively.

The season for fresh fruit has now ended, factories in Johore and Selangor are closed, available fruit going to the Singapore factories. Selangor fruit was 50 to 60 cents per 100, Negri Sembilan $2 to $4 per 100, Johore South, 1st quality $1 to $2, 2nd quality 60 cents to $2.20, 3rd quality 30 cents to $1 per 100. In north Johore the three qualities were, for 100 fruits $2 to $3, $1.50 to $2, $1.

Beverages.

Tea.—Seven consignments of lowland tea comprising 370 packages and two of upland tea comprising 198 packages were sold on the London market during September. The lowland tea sold at prices between 1s. 0½d. to 11d., the average price being 11.64d. per lb. The upland tea sold at 1s. 2d. and 1s. 1¼d., the average being 1s. 1. 62d. per lb.

According to the *Tea Brokers' Association of London Report* for September the average London price per lb. realized during the month for consignments of tea from other countries were as follows:—Ceylon 1s.4.04d., Java 1s.1.77d., Indian Northern 1s.3.77d., Indian Southern 1s.1.31d., Sumatra 11.06d.

The latest Colombo average prices available, quoted from *The Ceylon Tea Market Report* of 27th September, 1938, of the Ceylon Brokers' Association, are as follows, in rupee cents per lb.:—High Grown Teas 75, Medium Grown Teas 67, Low Grown Teas 62.

Coffee.—Sourabaya coffee prices in Singapore ranged from averages of $12.30 to $10.90 and Palembang coffee between $10.80 and $9.80 per picul, the price within the range depending on quality. Liberian coffee was quoted throughout the month at $14.50 per picul, Excelsa $9.00 per picul and Robusta $6.00 per picul.

Spices.

Arecanuts.—The average of highest and lowest market prices in Singapore during September were as follows:—Splits $7.30 to $4.85; Red Whole $6.68 to $5.19; Sliced $8.80 to $7.10, as compared with $8.22 to $5.10, $7.25 to $6.10, $9.37 to $8.19 respectively in August. The price within these ranges depends on quality.

The average of Singapore Chamber of Commerce quotations per picul were Best $8.15, Medium $7.70, Mixed $6.90, as compared with $7.62, $7.01 and $6.50 respectively in August.

Pepper.—Market stagnant, and prices lower. Average prices per picul in September were:—Black $8.01, White $12.45, Muntok $12.70 as compared with $8.12½, $13.06 and $13.31 in August.

Nutmegs.—Both 110's and 80's improved $2 per picul early in the month. Average prices in September were $30.60 per picul as compared with $30.25 in August.

Mace.—Singapore prices in September were the same as for the previous month, *viz.*: Siouw $80 and Amboina $62 per picul.

Cloves.—Nominal prices were again quoted in Singapore throughout the month at $40 per picul for both Zanzibar and Amboina cloves.

Cardamoms.—The latest available price for green cardamoms as given in *The Ceylon Chamber of Commerce Weekly Report* for 26th September 1938, is from 90 cents to Rs. 1.16 per lb.

Miscellaneous.

Derris.—The Singapore prices of derris during September remained unchanged at prices ruling in the previous month, *viz.* root sold on basis of ether extract $14 per picul, root sold on basis of rotenone content $18 to $20 per picul.

Gambier.—Singapore prices per picul for gambier have been quoted throughout September as follows:—Block $7.25, Cube No. 1 $15, as compared with average prices of $7.42 and $5 respectively in August.

Tapioca.—Prices in Singapore during September were the same as those during the previous month, *viz.*: Flake Fair $4.10, Seed Pearl 3.90, Medium Pearl $4.50 per picul.

Sago.—The Singapore price of Pearl rose from $2.17½ per picul at the beginning of the month to $3.85 at the end of the month, the average price being $3.18 as compared with $3.75 in August. Flour Sarawak Fair was $2.15 at the beginning of the month and $2.50 at the close, the average price being $2.29 as compared with $2.04 in August.

Tobacco.—The price of uncured tobacco ranged between $2 and $6 per picul. Dry leaf in Johore was anything between $5 and $42 per picul. Prices of "cured" tobacco fell considerably in Kedah, but improved slightly in Penang and Province Wellesley. In Negri Sembilan prices in the Kuala Pilah District were over 100 per cent. higher than those ruling in the adjacent District of Tampin. Increased planting is reported from several States. The general range in prices per picul in the more important centres of production were as follows:—Grade I $27 to $38, Grade II $20 to $27, Grade III $11 to $18. In Kelantan prices remain very high:—I $100 to $160, II $75 to $128, III $50 to $112.

GENERAL RICE SUMMARY.*

August, 1938.

Malaya.—The imports of foreign rice during August were 83,031 tons† and exports 17,819 tons, net imports being 65,211 tons as compared with 63,985 tons in 1937.¶

Of the imports during August, 47 per cent. were consigned to Singapore, 21 per cent. to Penang, 5 per cent. to Malacca, 20 per cent. to the Federated Malay States and 7 per cent. to the Unfederated Malay States. The August gross foreign imports by countries of origin were as follows (in tons, percentages in brackets):—Siam 51,371 (61.9), Burma 27,395 (33.0), French Indo-China 3,036 (3.6), other countries 1,229 (1.5).

For the first eight months of 1938, total imports of rice amounted to 544,570 tons of which 63.3 per cent. was Siam rice and 32.6 per cent. Burma rice.

Of the August 1938 exports, 81 per cent. were consigned to the Netherlands Indies and 19 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):—Siam 13,320 (74.8), Burma 4,003 (22.5), French Indo-China 416 (2.3), parboiled 43 (0.2), Malayan 37 (0.2).

Net imports of rice during August by countries of origin were, in tons: Siam 38,051, Burma 23,392, French Indo-China 2,620, elsewhere 1,149.

India and Burma.—Foreign exports for the period January to July inclusive were 164,000 tons, as compared with 610,000 tons in 1937, a decrease of 73.1 per cent. Of these exports 3.0 (4.3) per cent. were to the United Kingdom, 4.9 (6.2) per cent. to the Continent of Europe, 37.2 (27.4) per cent. to Ceylon, 4.9 (22.9) per cent. to the Straits Settlements and the Far East, and 50.0 (39.2) per cent. to other countries. The percentages in brackets are for 1937.

Exports from Burma from 1st January to 24th August were 2,366,314 tons, as compared with 2,428,579 in 1937, a decrease of 2.6 per cent. Of the 1938 exports 41.2 (46.5) per cent. went to India, 9.8 (8.8) per cent. to the United Kingdom, 8.8 (10.8) per cent. to the Continent of Europe, 11.6 (10.9) per cent. to Ceylon, 14.0 (12.2) per cent. to the Straits Settlements and the Far East and 14.6 (10.8) per cent. to other countries. The figures in brackets are for 1937.

Average August prices in rupee cents per 100 baskets of 75 lbs. each at Rangoon were 222 for Big Mills Special, and 236 for Small Mills Specials, an increase of 3 and 2 rupees respectively over July quotations.

Siam.—Exports of rice and rice products from Bangkok during June were 120,219 tons, as compared with 60,949 tons in 1937. For the first 6 months of 1938 exports were 818,709 tons as compared with 501,782 tons in 1937.

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* Abridged from the Rice Summary for August, 1938, compiled by the Department of Statistics, Straits Sttlements and Federated Malay States.

† Ton = long ton (2,240 lbs.)

¶ It is to be understood throughout the Summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1937.

Japan.—According to a report dated 5 September 1938, the final figures for the first Formosan rice crop of 1938 amounted to 685,055 tons, of which 432,744 tons was "Horai" rice, 243,601 tons Formosan "wet" rice and 8,710 tons Formosan "dry" rice. The total crop for the two previous seasons was 618,711 tons in 1937 and 664,559 tons in 1936. The actual yield of the first rice crop showed an increase of 32,989 tons or 5.1 per cent. over the estimate and is the highest rice crop record for Formosa.

The area under rice was 713,491 acres, a decrease of 4.3 per cent. in comparison with the corresponding period of 1937.

French Indo-China.—Entries of padi into Cholon during the first 8 months of 1938 were 840,320 tons as compared with 1,115,341 tons in 1937, a decrease of 24.7 per cent. Exports of rice during the same period were 872,371 tons as compared with 1,076,989 tons in 1937, a decrease of 19.0 per cent.

The Saigon rice report for July states that padi and rice prices were almost stationary. Demand from France was less active, that of other customers almost nil, but Hong Kong demand was maintained. The price of rice remained unchanged at $3.40 (Straits) per picul until the 12th and weakened to $3.39 per picul on 15th, and closed at this figure, after small fluctuations. Padi, with small arrivals, increased slightly from $2.20 per picul on 1st to $2.22 per picul on 15th, and $2.23 per picul at the end of the month.

Netherlands Indies.—According to *The Netherlands Indies Economic Bulletin* for May 1938, the area under rice harvested during January to March 1938 amounted to 1,205,360 acres, a decrease of 12.9 per cent. as compared with 1,383,200 acres for the corresponding period of 1937.

Exports of rice (in long tons) from Java and Mandoera to the Outer Provinces for January and February 1938 were 10,835 tons. Imports of rice into the Outer Provinces from abroad for the same period were 70,844 tons and into Java and Madoera 21,390 tons.

Ceylon.—Imports of rice for the first 8 months of 1938 amounted to 376,088 tons as compared with 360,267 tons in 1937, an increase of 4.4 per cent. Of these imports 17.6 (17.1) per cent. were from British India, 70.6 (70.2) per cent. from Burma, 0.3 (0.1) per cent. from the Straits Settlements and 11.5 (12.6) per cent. from other countries. The percentages in brackets are for the corresponding period of 1937.

Europe and America.—Shipments from the East to Europe for the period 1st January to 11th August 1938 were 904,396 tons, as compared with 816,309 tons in 1937, an increase of 10.8 per cent. Of these shipments 43.0 (45.7) per cent. were from Burma, 46.5 (47.2) per cent. from Saigon, 9.1 (5.0) per cent. from Siam and 1.4 (2.1) per cent. from Bengal. The figures in brackets are for 1937.

Shipments for the Levant from 1st January to 3rd August were 26,735 tons, as compared with 11,481 tons in 1937, an increase of 132.9 per cent.

Shipments for Cuba, West Indies and America from 1st January to 23rd July were 122,075 tons, as compared with 174,658 tons in 1937, a decrease of 30.1 per cent.

MALAYAN AGRICULTURAL EXPORTS, JULY, 1938.

PRODUCT.	Net Exports in Tons				
	Year 1937	Jan./July 1937	Jan./July 1938	July 1937	July 1938
Arecanuts ...	30,084	19,838	23,705	3,002	1,446
Coconuts fresh ...	95,223†	53,409†	61,053†	10,991†	10,584
Coconut oil ...	39,762	21,394	24,630	3,374	3,372
Copra ...	75,592	37,753	25,445	10,180	7,001
Gambier, all kinds ...	1,955	1,133	870	144	132
Copra cake ...	15,026§	8,020§	4,230§	1,925§	661§
Palm kernels ...	7,312	3,459	4,842	691	540
Palm oil ...	42,787	22,383	29,278	1,769	3,708
Pineapples, canned ...	80,502	55,866	49,689	9,138	6,989
Rubber ...	503,127¶	272,462¶	231,134¶	41,721¶	27,892¶
Sago,—flake ...	15,478	7,572	2,672	725	986
,, —pearl ...	3,759	1,722	2,318	251	380
,, —raw ...	8,256*	4,473*	3,240*	588*	193*
Tapioca,—flake ...	1,058	652	514	58	36
,, —flour ...	2,393*	1,066*	2,174*	211*	87*
,, —pearl ...	18,786	8,467	10,009	6	1,364
Tuba root ...	573	386	284	62	68

† hundreds in number. * net imports. ¶ production. § gross exports.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS

(In long tons, as declared by Estates)

Month 1938	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January	2,241.7	1,309.2	383.7	232.0
February	2,040.4	1,457.1	370.4	261.0
March	2,359.6	1,843.1	446.8	344.0
April	1,963.7	1,122.6	353.6	218.0
May	1,491.7	1,480.7	274.8	258.0
June	1,773.5	1,781.2	315.9	247.0
July	2,546.5	2,134.2	450.8	311.0
August	3,587.4	2,798.1	587.8	437.0
Total ...	18,004.5	13,926.2	3,183.8	2,308.0
Total January to August, 1937	16,794.0	11,947.0	2,925.8	1,929.3
Total for the year 1937 ..	27,733.5	17,932.8	5,094.7	2,811.4

Stocks on estates as at 31st August, 1938 were palm oil 2,031 tons, palm kernels 1,080 tons.

MALAYAN RUBBER STATISTICS

Acreages of Tappable Rubber actually Tapped and not Tapped on Estates of 100 Acres and over, for the Month ending 31st August, 1938.

State or Territory	Estimated Acreages of Tappable Rubber	Actual area tapped during the month Acreage	Percentage of (3) to (2)	Acreages of tappable rubber not tapped: Estates which have entirely ceased tapping — Acreage	Percentage of (5) to (2)	On estates which have partly ceased tapping: Otherwise than under rotational systems — Acreage	Percentage of (7) to (2)	Under rotational systems — Acreage	Percentage of (9) to (2)	Area of Tappable Rubber never been tapped — Acreage	Percentage of (11) to (2)	Total area not tapped (5) + (7) + (9)	Percentage of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
S. S.—													
Province Wellesley ...	43,356	18,880	43.5	932	2.2	14,888	34.3	8,656	20.0	448	1.0	24,476	56.5
Malacca ...	121,665	55,638	45.7	4,095	3.4	31,170	25.6	30,762	25.3	1,735	1.4	66,027	54.3
Penang ...	2,488	1,192	47.9	nil	nil	1,236	49.7	60	2.4	18	0.7	1,296	52.1
Singapore ...	32,140	16,263	50.6	3,729	11.6	6,788	21.1	5,360	16.7	143	0.4	15,877	49.4
Total S.S. ...	199,649	91,973	46.1	8,756	4.4	54,082	27.1	44,838	22.4	2,344	1.2	107,676	53.9
F. M. S.—													
Perak ...	286,369	157,076	54.9	8,293	2.9	67,145	23.4	53,855	18.8	6,638	2.3	129,293	45.1
Selangor ...	323,691	194,225	60.0	6,364	2.0	58,816	18.2	64,286	19.8	6,855	2.1	129,466	40 0
Negri Sembilan ...	254,961	135,564	53.2	9,288	3.6	58,904	23.1	51,205	20.1	7,498	2.9	119,397	46.8
Pahang ...	86,291	47,757	53.3	3,571	4.1	24,383	28.3	10,580	12.3	6,379	7.4	38,534	44.7
Total F.M.S. ...	951,312	534,622	56.2	27,516	2.9	209,248	22.0	179,926	18.9	27,370	2.9	416,690	43.8
U. M. S.—													
Johore ...	475,823	270,815	56.9	18,035	3.8	118,080	24.8	68,893	14.5	32,443	6.8	205,008	43.1
Kedah ...	199,631	114,295	57.3	9,410	4.7	33,378	16.7	42,548	21.3	6,469	3.2	85,336	42.7
Kelantan ...	31,250	19,838	63.5	253	0.8	5,844	18.7	5,315	17.0	2,103	6.7	11,412	36.5
Trengganu (*b*) ...	4,817	3,182	66.1	nil	nil	74	1.5	1,561	32.4	74	1.5	1,635	33.9
Perlis (*c*) ...	1,371	667	48.7	224	16.3	417	30.4	63	4.6	86	6.3	704	51.3
Brunei ...	5,732	2,566	44.8	nil	nil	2,402	41.9	764	13.3	261	4.6	3,166	55.2
Total U.M.S. ...	718,624	411,363	57.2	27,922	3.9	160,195	22.3	119,144	16.6	41,436	5.8	307,261	42.8
Total Malaya ...	1,869,585	1,037,958	55.5	64,194	3.4	423,525	22.7	343,908	18.4	71,150	3.8	831,627	44.5

Notes:—(*a*) The acreage shown in column (11) is included in columns (5) and (7).
(*b*) Registered companies only
(*c*) Figures for the quarter ending 30th June, 1938.

MALAYAN RUBBER STATISTICS Table I.

ACREAGE, STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF AUGUST, 1938 IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to Aug. 1938		during the month		January to Aug. 1938						
	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to Aug. 1938	during the month	Jan. to Aug. 1938	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to Aug. 1938
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	10,260	16,743	9,833	89,140	3,582	41,415	Nil	Nil	Nil	Nil	10,539	4,802	98,373	30,142	...	7,008	18,053	16	126
Johore ...	...	4,043	6,903	4,338	40,747	2,535	24,501	Nil	52	Nil	196	2,496	4,866	24,179	40,390	...	2,954	7,555	...	...
Kedah ...	...	345	4,293	2,326	22,030	709	7,121	Nil	Nil	Nil	Nil	1,399	1,638	13,946	14,698	...	218	4,418	...	...
Perlis ...	...	31	25	8	102	16	175	Nil	Nil	Nil	Nil	Nil	29	Nil	251	...	25	26	...	...
Kelantan ...	...	728	445	351	2,910	431	4,923	Nil	Nil	Nil	Nil	265	419	2,175	5,463	...	767	514	...	...
Trengganu ...	...	55	50	249	2,106	124	1,053	Nil	Nil	Nil	Nil	Nil	373	Nil	3,159	...	55	50	...	...
Brunei ...	...	17	57	41	367	62	544	...	...	...	...	...	108	...	917	...	10	59	...	...
Total Malay States	...	15,479	28,516	17,156	157,402	7,459	79,732	Nil	52	Nil	196	14,699	12,235	138,673	95,020	...	11,037	30,675	16	126
S. SETTLEMENTS :—																				
Malacca ...	...	2,299	1,664	924	8,847	336	*4,044	Nil		Nil		1,865		18,913		...	2,103	1,808	...	...
Province Wellesley	...	3,081	735	339	3,294	337	1,948	Nil		Nil		6,217		59,118		...	3,224	757	...	...
Penang ...	1,149	5,660	15	14	141	59	655	3,130	10,527	19,760	98,017		Nil		Nil	1,134	6,392	8	...	...
Singapore ...	4,716	34,011	245	118	1,165	1	410	10,554		90,951		24,465		154,680		5,120	28,371	261	24	197
Labuan ...	...	47	Nil	Nil	Nil	11	95	51		379		Nil		Nil		...	49	Nil	...	...
Total Straits Settlements ...	5,865	45,098	2,659	1,395	13,450	744	7,152	13,735	10,527	111,090	98,017	32,547	Nil	232,711	Nil	6,254	40,139	2,834	24	197
Total Malaya ...	5,865	60,577	31,175	18,551	170,852	8,203	86,884	13,735	10,579	111,090	98,213	47,246	12,235	371,384	95,020	6,254	51,176	33,509	40	323

*Amended:—153 tons over reported in May and 1 ton under reported in June.

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,053	27,505	6,161	5,220	2,329	87
WET RUBBER	955	866	231	166	625	131
TOTAL ...	7,008	28,371	6,392	5,386	2,954	218

TABLE III
FOREIGN EXPORTS

PORTS	For month	Jan. to Aug. 1938
29	30	31
Singapore ...	33,847	246,925
Penang ...	8,994	87,669
Port Swettenham.	4,233	35,014
Malacca ...	272	1,776
MALAYA ...	47,246	371,384

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	Jan. to Aug. 1938
32	33	34
Malay States ...	26,880	233,218
Straits Settlements	2,506	20,172
MALAYA ...	29,386	253,390

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S and F.M.S., at Singapore on 22nd September, 1938

METEOROLOGICAL SUMMARY, MALAYA, AUGUST, 1938.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of		Mean of A and B	Absolute Extremes				At 1 foot	At 4 feet	Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.		Highest Max.	Lowest Min.	Lowest Max.	Highest Min.					Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hrs.	hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	89.4	71.4	80.4	94	68	83	74	83.1	84.6	4.71	119.6	1.36	20	15	1	4	—	156.50	5.05	41
Bukit Jeram, Selangor ...	88.0	71.9	79.9	92	70	81	75	83.4	86.3	6.08	154.4	1.23	20	17	2	—	2	174.20	5.62	46
Sitiawan, Perak ...	88.9	72.8	80.9	92	71	82	75	84.3	85.4	4.54	115.3	0.60	16	13	1	—	—	181.00	5.84	48
Ipoh Aerodrome, Perak ...	89.0	71.9	80.5	92	69	83	74	82.3	84.1	10.04	255.0	2.47	21	19	4	—	1	163.05	5.26	43
Temerloh, Pahang ...	89.6	71.6	80.6	93	69	81	74	85.3	86.8	2.22	56.4	0.69	11	10	1	9	—	163.20	5.26	43
Kuala Lipis, Pahang ...	88.8	70.9	79.9	92	69	79	73	83.6	85.3	13.64	346.5	2.02	20	19	4	22	1	171.75	5.54	45
Kuala Pahang, Pahang ...	86.5	73.5	80.0	89	72	79	76	86.0	87.7	4.18	106.2	2.47	11	6	2	—	1	208.10	6.71	55
Kallang Aerodrome, S'pore ...	84.3	76.2	80.3	88	72	79	81	82.1	83.7	9.35	237.5	1.81	21	14	1	—	—	143.35	4.62	38
Bayan Lepas Aerodrome Penang ...	85.8	74.2	80.0	89	72	77	77	83.5	84.9	15.04	382.0	4.94	19	18	1	—	3	188.65	6.09	49
Malacca Town, Malacca ...	84.3	73.3	78.8	87	70	80	75	82.5	84.6	9.83	249.7	2.95	18	16	10	—	3	162.45	5.24	43
Kluang, Johore ...	87.1	70.6	78.9	90	69	81	73	81.3	82.5	4.30	109.2	1.30	15	10	4	6	—	148.05	4.77	39
Mersing, Johore ...	86.9	71.3	79.1	90	69	80	73	82.2	82.7	3.88	98.6	0.80	16	15	1	—	—	171.40	5.53	45
Alor Star, Kedah ...	86.3	73.4	79.9	90	71	77	76	84.2	85.9	14.07	337.4	2.10	25	21	1	1	2	174.00	5.61	46
Kota Bahru, Kelantan ...	88.7	73.4	81.1	91	72	85	76	84.6	85.4	12.67	321.8	2.74	19	18	5	—	—	220.95	7.13	58
Kuala Trengganu, Trengganu	87.5	72.2	79.9	91	70	76	74	82.9	85.3	5.57	141.5	1.90	14	9	2	1	—	195.30	6.30	51
Labuan ...	86.4	75.3	80.9	89	72	83	78	84.3	86.4	23.11	587.0	4.66	25	22	3	—	—	234.20	7.55	61
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	74.8	61.8	68.3	78	60	69	63	72.3	72.8	3.47	88.1	0.94	18	16	2	17	3	158.50	5.11	42
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.9	55.8	63.9	75	50	63	60	70.1	70.4	8.07	205.0	1.32	26	24	1	7	2	113.35	3.66	30
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.3	58.2	64.7	75	54	63	60	*	*	7.84	199.1	1.28	23	23	*	*	*	115.15	3.71	30

* Not recorded.

Compiled from Returns supplied by the Meteorological Branch, Malaya.